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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/071,809	02/07/2002	Tinghao F. Wang	10200-16	9444

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EXAMINER	
DEO, DUY VU NGUYEN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 08/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/071,809	WANG, TINGHAO F.	
	Examiner	Art Unit	
	DuyVu n Deo	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 June 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-12,14-23,25 and 27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 3-12, 14-23, 25, 27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 3-12, 14, 15, 21, 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai (US 5,880,033).

Tsai describes a method of etching metal silicide (WSi) using Cl2 and O2. The pressure is ranging from 2-20 mTorr, 4 mTorr is used in the example. The first power is about 200-2000 watts, and second power (bias power) is about 5-500 watts. The Cl2 flow rate is about 20-800 sccm, and O2 flow rate is about 1-50 sccm (summery; col. 4, line 14-15; col. 5, line 1-25; col. 7, line 10-25, line 50-col. 8.) Unlike claimed invention, Tsai doesn't describe the claimed O2 concentration of 25 % V or greater, such as 25-30% V. However, he shows a O2 high flow rate or concentration (concentration of etchant would be proportional to the flow rate), are desirable, an increase in O2 flow rate from 0 to 10 sccm increases the WSi etch rates from 250 nm/min to 350 nm/min; he also teaches the power ratio of the first power to the second power is selected to enhance the ability of the etchant plasma to anisotropically etch the metal silicide layer and the flow rates are dependent upon the size of the process chamber. Therefore, it would have been obvious for one skill in the art through routine experimentation to determine the optimum parameters such as flow rates power level in order to etch WSi with high etch rate and high

selectively to the under polysilicon layer, such as 30 or more, with an anticipation of an expected result.

Concerning to claims 10 and 11, the time to completely etch WSi would have been obviously depending on other factors such as WSi thickness and parameters. A 30 seconds time period would be achievable since Tsai's parameters are overlap claimed parameters.

3. Claims 1, 3-12, 14, 15, 21, 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tabara et al. (US 6,150,250) and Tsai (US 5,880,033).

Tabara describes a method for etching WSi in a Cl2/O2 environment having flow rate of 25 sccm for Cl2 and 11 sccm for O2, which would provide an O2 concentration of higher than 25% by volume (col. 7, line 5-15), or O2 is form 0-13 sccm. Even though he is silent about the ratio etch rate, of the WSi to the poly, of at least 30; however since the etching gas includes the same gas and the same concentration of O2 as that of the claims, his method would provide claimed the ratio etch rate, of the WSi to the poly, of at least 30. The source power is 1400W and the radio frequency power (bias power) is 40W (col. 7, line 12-13).

Unlike claimed invention, Tabara doesn't describe the claimed parameters such as 2-40 mtorr such as 3mtorr P, source power at 400W, 25-30% volume O2, 45 sccm Cl2, 30 sccm O2, and a 30-seconds of etching. Tsai describes a method of etching metal silicide (WSi) using Cl2 and O2. The pressure is ranging from 2-20 mTorr, 4 mTorr is used in the example. The first power is about 200-2000 watts, and second power (bias power) is about 5-500 watts. The Cl2 flow rate is about 20-800 sccm, and O2 flow rate is about 1-50 sccm (summery; col. 4, line 14-15; col. 5, line 1-25; col. 7, line 10-25, line 50-col. 8). These processing parameters include claim parameters. Therefore, it would have been obvious for one skill in the art through routine

experimentation to determine the optimum parameters such as flow rates power level in order to etch WSi with high etch rate and high selectively to the under polysilicon layer, with an anticipation of an expected result.

4. Claims 22, 23, 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai or Tabara as applied to claims 1 and 21 above, and further in view of Langley et al. (Semiconductor International, October 1989).

Unlike claims 22, 23, and 25, above prior art doesn't describe a breakthrough etch using gas comprising CF4. Langley teaches method of etching silicide/poly wherein he teaches etching a native oxide on the silicide using a gas comprising CF4 (pg. 97, 1st col., 2nd paragraph) before etching the silicide. This would reads on claimed breakthrough etch. It would have been obvious at the time of the invention for one skill in the art to modify Tsai or Tabara in light of Langley in order to remove a native oxide on the silicide before etching of the silicide.

Declarations

5. The Declaration of Mr. Krishnaswamy Ramkumar under 37 CFR 1.132 filed 6/1/04 has been considered and found unpersuasive to over the rejection as set forth above because it generally asserts that the claimed invention provide unexpected result without showing factual comparison between the claimed invention and the applied prior art. Furthermore, there is no unexpected result when one skilled in the art, such as Tsai, suggests that increasing the O2 would increase the metal silicide etching selectivity over the poly-Si (col. 7, lines 50-61).

Response to Arguments

6. Applicant's arguments filed 6/1/04 have been fully considered but they are not persuasive.

Applicant's argument about Tsai teaching of O2 concentration at 15% and selectivity over poly-Si of about 5 is acknowledged. However, that is just one of the examples taught by Tsai. He suggests a range of Cl2 at 20-800 sccm and O at 1-50 sccm (col. 8, lines 24-33). This would certainly include claimed of O2 concentration of over 25% by V. Therefore, these range would include claimed ratio etch rate of at least 30. Furthermore, Tsai teaches as the O2 flow rate increases, the metal silicide etching rate also increases and decreases poly-Si etching rate; therefore increasing the selectivity of the metal silicide over the poly-Si (col. 7, lines 50-61).

Referring to applicant's argument that figure 20 in Tabara shows the poly-Si is always etched faster than WSi2, there is no poly-Si showed in the figure 20. Applicant has not traversed that Tabara's O2 concentration, which is the same as that of claimed invention, would not provide claimed selectivity.

The rejection under Bourassa has been withdrawn since he describes using O2 and Freon and not claimed O2 and Cl2.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6:00-3:30; with alternate Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DVD
8/16/04

DD